



August 3, 2017

VIA ECFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, NW
Washington, DC 20554

Re: Indoor Location Accuracy Implementation Plan and Progress Report
Wireless E911 Location Accuracy Requirements
PS Docket No. 07-114

Dear Ms. Dortch:

Pursuant to the 47 C.F.R. 20.18(i)(4)(i)-(ii) of the Commission's rules, GCI Communication Corp. ("GCI") is required to file an Initial Implementation Plan and Progress Report by August 3, 2017. Attached please find GCI's Initial E911 Indoor Location Accuracy Implementation Plan and Progress Report.

Please direct any questions to the undersigned.

A handwritten signature in black ink, appearing to read "Kara Leibin Azocar", with a stylized flourish at the end.

Kara Leibin Azocar
Regulatory Counsel, Federal Affairs
GCI Communication Corp.

**GCI COMMUNICATION CORP. (GCI) – INDOOR 911 LOCATION ACCURACY
IMPLEMENTATION PLAN AND PROGRESS REPORT
PS DOCKET NO. 07-114
August 3, 2017**

I. INTRODUCTION

The Federal Communications Commission’s (“FCC’s” or “Commission’s”) *Fourth Report and Order* on Wireless E911 Location Accuracy requires that non-nationwide CMRS providers report to the Commission on their initial implementation plans and progress toward improving indoor location accuracy (see 47 C.F.R. §20.18(i)(4)(i) & §20.18(i)(4)(ii)).¹ This report will lay out the steps that GCI Communication Corp. (“GCI”) has taken since the adoption of the *Fourth Report and Order* to improve location accuracy on its network and the plans it intends to take in the near future.

This document describes the relevant elements of GCI’s Implementation Plan (the “Plan”) for meeting the Commission’s rules for indoor location accuracy, together with the status of GCI’s progress toward meeting each element (“Progress Report”). GCI’s Plan incorporates many elements of the Parallel Path,² as adapted to the requirements of the rules and to developments in technology and policy that have arisen since the rules became effective.³ This Plan is necessarily a snapshot of GCI’s current intentions, objectives and progress. The Plan will need to evolve in response to improvements (and unforeseen shortcomings) in technology, and to the capabilities and plans of critical vendors in the communications ecosystem. GCI is a non-nationwide provider (Tier II) who has deployed VoLTE in part, but not all, of its network and, as such, it plans to meet all of the applicable deadlines for compliance under the *Fourth Report and Order*.

The Plan describes the various solutions GCI intends to use and evaluate for its compliance. GCI uses a number of methods to assess the performance of these various solutions to ensure they are reliable and will meaningfully contribute to GCI’s compliance and to PSAPs’ and customers’ needs. For currently deployed technologies, GCI uses periodic empirical accuracy testing in representative call scenarios and locations to ensure the technologies are operating at optimum accuracy levels. GCI also regularly monitors performance results to ensure that ongoing performance of live 911 calls remains consistent. GCI’s engineering teams

¹ See *Public Safety and Homeland Security Bureau Provides Guidance to CMRS Providers Regarding Upcoming E911 Indoor Location Accuracy Reporting Requirements*, PS Docket No. 07-114, Public Notice, DA 17-675 (rel. July 13, 2017).

² See Competitive Carriers Association Ex Parte Letter, PS Docket No. 07-114, WC Docket No. 10-90 (filed Jan. 23, 2015); and Competitive Carriers Association Ex Parte Letter, Attachment “A Parallel Path for Competitive Carriers’ Improvement of E911 Location Accuracy Standards,” PS Docket No. 07-114 (filed Jan. 16, 2015) (“Parallel Path”).

³ See *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114, Fourth Report and Order, FCC 15-9 (rel. Feb. 3, 2015) (“*Fourth Report and Order*”).

and technology vendors investigate and rectify (to the extent possible) any perceived underperformance. GCI also hopes to acquire and use new tools to assess network performance on an ad hoc basis. And it is GCI's internal policy to review and test potential enhancements to its existing technologies and to evaluate new technologies that would measurably improve location performance, including field tests from challenging indoor location sites.

II. BACKGROUND

GCI is working hard to continue complying with the rules and to stay current on technology. For example, GCI is working to decommission its GSM and CDMA networks, deploy VoLTE across its LTE footprint, and keep software current to have the capability in the network to achieve improvements as soon as technological advancements becomes available to GCI to do so.

GCI is a Tier II carrier awaiting advanced location accuracy technologies to reach its market. GCI works closely with original equipment manufacturers ("OEMs"). Relationships with OEMs are limited, however, for Tier II carriers, and GCI's conversations with such entities generally cover launches in the near-term, rather than long-term goals. Due to the short timeframe covered by those discussions, such conversations have not yet involved the timing of the development and deployment of various future E911 technologies like assisted GNSS, OTDOA, crowd sourced Wi-Fi positioning, or device based hybrid approaches. As soon as devices with such capabilities become available to GCI, and are approved for emergency call positioning, GCI will work to take advantage of them to the extent that deploying systems to support these solutions enhance its ability to provide an improved location fix. Thus, GCI works to stay current on technology in its network that will be compatible with such devices and enable such solutions to improve 911 location accuracy for its customers and public safety stakeholders.

For example, GCI hopes to deploy OTDOA across its entire LTE footprint with the deployment of emergency calling over VoLTE. OTDOA deployment entails a number of significant steps, including: precise measurements of cable delays; hiring of professional surveyors to obtain accurate latitude/longitude measurements of LTE antennas; and improvements in GCI's cell site database to improve OTDOA's effectiveness. In addition, GCI plans to eventually implement a number of enhancements to allow use of OTDOA instead of AFLT (currently used for CDMA) as the network-based fallback location technique when a satellite-based GPS location fix is unavailable and the handset is in LTE coverage. GCI anticipates deploying this solution once OEMs make devices with such capability available to GCI, and will prepare to make the network capable of doing so in the interim.

Finally, GCI works closely and in good faith with public safety stakeholders in Alaska to ensure that the location information delivered over PSAP interfaces to PSAP call handling equipment is presented in a manner that is understandable and helpful for emergency dispatch. Quality control measures and outreach efforts by the broader industry groups and standards setting committees will apply to GCI's indoor location accuracy enhancements as soon as GCI is able to take advance of such efforts.

III. HORIZONTAL REQUIREMENTS

In the *Fourth Report and Order*, the FCC adopted new rules that require wireless providers to generate either a Dispatchable Location or x/y location information within 50 meters accuracy (as determined by Test Bed performance) for a certain percentage of wireless calls to 9-1-1 within specific timeframes. The Commission's rules for horizontal location are designed to give wireless service providers incentive to improve the percentage of wireless 911 calls over time that use technologies most likely to deliver highly accurate caller location information to PSAPs. Consistent with the general objectives of the Parallel Path, GCI's Plan is designed to meet these requirements through a combination of technologies that will enable the delivery of either a "dispatchable location" or an x/y geographic coordinate within 50 meter accuracy.

A. Improving the Accuracy of X/Y Coordinates.

GCI is working to improve the accuracy of x/y coordinates delivered to PSAPs by seeking to improve and supplement its existing Assisted-GPS ("A-GPS") solution already deployed ubiquitously throughout its GSM, UMTS, and CDMA networks. Additionally, as indicated above GCI plans to deploy VoLTE in conjunction with implementing eSMC/LPP support for emergency call positioning to support new emerging positioning technologies.

Test Bed. Service providers, consumers and PSAPs will benefit from a variety of available viable location solutions. GCI thus supports implementation and ongoing operation of the location accuracy Test Bed beyond the bare minimum needed to meet its regulatory obligations. Accordingly, where feasible and appropriate, GCI will support the testing of E911 location solution vendors' technologies through its network and personnel resources.

Status. The FCC's *Fourth Report and Order* established an independent "Test Bed" to allow stakeholders to evaluate different emergency call location technologies across various indoor environments in order to determine the location of emergency calls placed indoors (the "Test Bed"). The only carriers who were anticipated to participate in the first round of the Test Bed in 2016 were the Tier I (nationwide) carriers who provide service in Atlanta and San Francisco. The following technologies were evaluated in the initial rounds of the Test Bed: AGPS, OTDOA, AGPS/OTDOA hybrid, ECID, RTT, AFLT, and AGPS/AFLT hybrid. GCI relied on the results of this nationwide Test Bed for assessing the compliance of its CDMA networks. GCI deployed the indoor location technology or technologies used in its networks consistently with the manner in which such technologies have been tested in the nationwide Test Bed.

Polaris Testing. In addition, Polaris Wireless ("Polaris") independently conducted testing of its position-domain Wireless Location Signature ("WLS") hybrid solution, which utilizes cellular and assisted Global Positioning System ("A-GPS"), in Anchorage, Alaska as deployed in the GSM and UMTS networks of GCI.⁴ Polaris' E911 location technology solution

⁴ See Letter from Michele C. Farquhar, Counsel to Polaris Wireless, Inc., to Marlene H. Dortch, Secretary, FCC, Notice of Ex Parte Presentation, PS Dkt. No. 07-114 (Dec. 3, 2015) (PSHSB suggested that Polaris implement parallel testing mechanisms for evaluating and certifying

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deployed as of the initial rounds of the Test Bed was different from the solutions deployed by nationwide carriers originally tested in the Test Bed. GCI relied on the results of this testing for assessing the compliance of its GSM network. GCI has deployed the indoor location technology or technologies used in its networks consistently with the manner in which such technologies have been tested in by Polaris.

Polaris discussed with the FCC's Public Safety and Homeland Security Bureau ("PSHSB") how it (and the non-nationwide carriers it serves) can best demonstrate compliance with the interim benchmarks utilizing the technology solution which Polaris has deployed in the market today.⁵ According to Polaris' summary of this meeting,⁶ PSHSB suggested that Polaris might consider implementation of parallel testing mechanisms for evaluating and certifying Polaris's E911 location solution, and CTIA agreed with such approach.⁷ Similar to the consideration given in the *Fourth Report and Order* to rural and regional carriers that do not provide service in the location(s) of the Test Bed, vendors that do not plan to provide service to any carrier in the Test Bed location(s) need an alternative means of validating their currently deployed solutions. Based on this discussion, GCI and Polaris understood that the *Fourth Report and Order* allowed alternative testing outside of the industry-led Test Bed process ("Parallel Testing"), "so long as the evaluation mechanisms and key performance indicators are substantially similar to those of the industry Test Bed, the testing itself is performed independently, and the carrier certifies that it has deployed the technology throughout its network in the same manner as tested."⁸

Polaris tested its E911 location accuracy solution on GCI's network using Parallel Testing mechanisms for evaluating and certifying Polaris's position-domain hybrid solution (as described above) on GSM and UMTS cellular networks. The Parallel Testing met the requirements of the *Fourth Report and Order* because:

Polaris's E911 location solution because its 9-1-1 location technology is not currently deployed by any of the nationwide carriers in the Test Cities); Letter from David S. De Lorenzo, PhD, Principal Research Engineer, Polaris Wireless, Inc., to Marlene H. Dortch, Secretary, FCC, Wireless E-911 Location Accuracy Requirements, PS Dkt. No. 07-114 (Dec. 22, 2015) (agreeing that it is appropriate for Polaris' non-nationwide carrier customers to engage in testing in parallel with the Test Bed in order to evaluate whether the Polaris-deployed technology complies with the interim benchmarks).

⁵ Polaris Wireless, Inc. Ex Parte Letter, PS Docket No. 07-114 (Dec. 3, 2015) ("*Polaris Ex Parte*"). See also CTIA—The Wireless Association Ex Parte Letter, PS Docket No. 07-114 (Dec. 22, 2015) ("*CTIA Ex Parte*").

⁶ *Polaris Ex Parte* at 2.

⁷ *CTIA Ex Parte* at 3.

⁸ *Polaris Ex Parte* at 2.

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- Polaris conducted Parallel Testing – outside of the Test Bed – in Anchorage, Alaska using evaluation mechanisms and key performance indicators that are substantially similar to those used in the Test Bed.
- Polaris represented to GCI that this testing itself was performed by Location Smart, who operated independently.
- GCI does not provide service in the location(s) of the Test Bed and certified that it has deployed the technology tested by Polaris throughout its network in the same manner as has been deployed in the portion of GCI’s network that Polaris has proposed to test.

During the testing, LocationSmart, the independent testing contractor, tested all location technologies deployed within the GCI GSM and UMTS network, including, A-GPS, Polaris’ WLS technology (a form of radiofrequency (“RF”) pattern matching), ECID, and CID to determine E911 location accuracy on GCI’s GSM and UMTS cellular network for both indoor and outdoor locations. Testing was performed using both A-GPS and Non-A-GPS devices. Polaris provided the results of such Parallel Testing to GCI in a manner in which it can determine compliance with FCC rules and regulations.

Status. On February 9, 2017, Polaris presented GCI with an updated analysis of the GCI Accuracy Test Report, dated June 29, 2016. This updated analysis concluded that, in Anchorage, AK, the GCI Network has met the third year benchmark requirements of the *Fourth Report and Order*, which require that 50% of all wireless 911 calls provide an x/y location within 50 meters. Network-wide accuracy was determined by applying the independent location accuracy test results to the mix of location method, e.g., Hybrid, WLS®, ECID, Cell-ID, cell site morphology, and indoor/outdoor accuracy mix. That mix of location method within the GCI network changed after implementation of software updates made by Polaris Wireless subsequent to the independent testing.

In compliance with the *Fourth Report and Order’s* indoor location accuracy testing and live call reporting methodology and following the parallel independent testing suggested by the FCC, analysis of accuracy testing and live call data statistics concludes that, using the Polaris WLS® Hybrid Positioning System deployed in the GSM and UMTS GCI Network in Anchorage, Alaska, the GCI network already meets the *Fourth Report and Order’s* third year horizontal location accuracy requirement due in 2018.

Using aggregate live 911 call location data collected during 2016 Q4 as reported in the E911 Compliance Update, the actual mix of location method showed an increase in the number of calls being located using the Hybrid method. Applying the same independent location accuracy test results collected by LocationSmart April 2016, along with accuracy test results from the Test Bed, to the 2016 Q4 live call data statistics, GCI’s GSM/UTMS and CDMA networks located E911 calls within 50m in more than 50% of calls.

Indoor Location Test Methodology. ATIS ESIF has and continues to develop the requisite test methodologies through a collaborative multi-stakeholder process, inclusive of wireless carriers, 9-1-1 service providers, public safety representatives, and technology solutions vendors. Adopted in June 2016, the ATIS Standard on Test Bed and Monitoring Regions

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Definition and Methodology (ATIS-0500031) provides the guidelines regarding Test Bed regions, morphologies, building types and construction materials (Test Cases). Specifically, the range of indoor operational environments in real world 9-1-1 call scenarios that would be identified for testing include:

- The four morphologies: Dense Urban, Urban, Suburban, and Rural.
- Within each morphology there are Setting/Use types – Commercial or Residential.
- Within a Commercial or Residential use type there are building categories. For example, Single Family Home, Multi Family home, Small office, Large commercial, or Arena, etc.
- Within each building category, there are different building types. For example – Low rise, high rise, glass exterior, brick, stucco, etc.

Status. As a member of ATIS, GCI receives information regarding the standards-setting process. However, GCI does not control and/or influence the standards-setting process.

A-GPS. Improvements continue to be made in the A-GPS chipsets in newer generations of handsets. One of the biggest improvements comes as a result of lower power requirements and better battery management associated with the GPS chipsets. As a result, this allows the handsets to keep A-GPS measurements active for extended periods of time, keeping a “hot status” of location in the handset. This allows for the location to be available much quicker after a caller dials 911. This capability also improves the device based hybrid capabilities since more accurate location is made available for “crowd-sourcing”. In addition, each new generation of GPS chipsets includes minor enhancements for improving the accuracy and sensitivity available from the chipset by including improvements such as multipath mitigation. As the handset vendors integrate the next generation of chipsets into their devices, GCI will continue to monitor the development and testing of advancements in A-GPS technology.

Likely the single biggest improvement to A-GPS would result from the inclusion of a secondary satellite system to augment the number of satellites available to the handset for GPS measurements. And the industry used a significant number of resources to test the “next” available GNSS Satellite System, (“GLONASS”) back in 2014 and 2015. While GLONASS provided nearly a 50% increase in the probability that a handset would see three or more satellite measurements (a minimum of three measurements are needed for a location) and showed improvements in accuracy, no permission was given to deploy GLONASS at this time, due to national security concerns.

Status. Because GCI’s footprint does not include any areas with a dense urban morphology, A-GPS positioning fixes on the GCI network do not suffer the performance degradation associated with dense urban morphology. While A-GPS will continue to improve location accuracy, GCI is hampered by limited access to devices with A-GPS capabilities. As a small regional wireless carrier, conversations with OEMs have not yet involved the timing of inclusion of other advancements in A-GPS capabilities.

GCI plans to work with vendors and other players in the communications ecosystem to incorporate methods into its E911 location accuracy solutions that will improve location accuracy including, but not limited to, crowd sources Wi-Fi positioning and device based hybrid approaches. These approaches will leverage solutions already used for commercial location-based services by providing handsets with yet additional position sources to improve the accuracy of x/y information transmitted to PSAPs. GCI also plans to work with other stakeholders to adapt these technologies to the 911 environment to ensure the reliability of the information and the seamless availability of the solution to consumers.

B. Dispatchable Location & *National Emergency Access Database* (“NEAD”)

GCI intends to begin using the NEAD as soon as possible after it becomes operational. The concept behind the NEAD is fairly straightforward: when a caller dials 911 from a Wi-Fi- or Bluetooth-enabled handset, the service provider network will automatically collect information from the wireless handset about nearby low-power wireless access points within the caller’s vicinity; the network, in turn, will query whether these wireless access points are in the NEAD database and associated with a verified street address plus additional location information as needed. If so, the wireless carrier network will determine which wireless access point street address information to provide as the 911 caller’s dispatchable location.

Status. GCI is not participating in the development of the NEAD database, so it is unable to provide detail as to implementation of the database further than what is provided above. GCI is unable to reasonably leverage the NEAD until VoLTE is more deployed throughout its network. This broader deployment of VoLTE will provide the basis for implementing the LTE Positioning Protocol (LPP), fundamental to the advanced positioning technologies currently under development.

GCI anticipates that it will undertake internal efforts necessary to enable its network and customers’ handsets to interact with and benefit from the NEAD, to the extent that it can. Once the NEAD is operational, GCI plans to initiate efforts to improve and update its wireless 911 location server to enable it to work with the NEAD. This is necessary to ensure that GCI’s network will appropriately process and prioritize location fixes from multiple location technologies (including dispatchable location), based on the accuracy and reliability of the fix. These measures also include implementing the LTE Positioning Protocol enhancements (LPPe) into GCI’s 911 server. This enhancement supplements the existing LPP standard and will allow devices to pass Wi-Fi access point information, Bluetooth beacon information, and Uncompensated Barometric Pressure information back to GCI’s network.

The NEAD solution also requires that LTE-enabled handsets transmit available Wi-Fi and other access point information to the service provider’s network when the user calls 911. GCI plans to incorporate this capability into the specifications for the handsets and underlying components (e.g. chipsets, operating systems) that it procures through the device ecosystem, and is currently working with those stakeholders to incorporate this capability into future handset model releases.

The availability of dispatchable location through the NEAD solution to 9-1-1 callers may be limited, however, if OEMs do not embrace the NEAD functionality in their products and/or make those products available to all carriers on a timely basis. The availability of devices that

integrate this specification, however, may come much later for Tier II carriers like GCI because access to such devices are generally limited, as discussed above. Ultimately, GCI anticipates that once the NEAD development is complete, the specifications are finalized, and supported devices are available to GCI, it would be prepared to support the solution.

IV. VERTICAL LOCATION ACCURACY REQUIREMENTS

The Commission's requirements for vertical location accuracy are designed to give wireless service providers incentive to deploy solutions that deliver a 911 caller's vertical location to those geographic areas where 911 callers are more likely to benefit from those capabilities. Service providers may comply with these requirements through two alternative means: maintaining a sufficient number of dispatchable location access points in the most populous service areas; or deploying an accurate vertical "Z-axis" solution across sufficient coverage within those service areas. In addition to pursuing dispatchable location solutions through the NEAD and other methods as detailed above, GCI is working with vendors and taking internal steps to facilitate the development and possible use of viable Z-axis solutions as well.

The rules related to this requirement currently apply to nationwide providers and non-nationwide carriers in the top 25 (by April 3, 2022) and in the top 50 CMAs (by April 3, 2024), which does not include any of the CMAs in which GCI operates. Regardless, GCI plans to stay current on the technology and be ready for use cases once such a solution becomes available in GCI's CMAs. GCI anticipates that will occur well after operators in the CMAs currently affected by the regulatory obligation develop the solution because handsets will still need to become available to non-nationwide carriers who are prepared to implement such solution. GCI is on track to make uncompensated barometric data available to PSAPs from any handset capable of delivering barometric sensor data when it implements LPP in conjunction with its deployment of emergency calling over VoLTE.

Please contact John Myhre of GCI at (907) 868-1546, John.myhre@GCI.com, if there are questions concerning this report.